Model 11

Syringe Pump Series

User's Manual

Model 11 Virtually Pulse Free Syringe Pump 55-2111

HARVARD

APPARATUS

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Serial Numbers

All inquires concerning our product should refer to the serial number of the unit. The serial number is located on the rear of the chassis.

Calibrations

All electrical apparatus is calibrated at rated voltage and frequency. While the flow will stay calibrated, the peak will vary.

Warranty

Harvard Apparatus warranties this instrument for a period of one year from date of purchase. At its option, Harvard Apparatus will repair or replace the unit if it is found to be defective as to workmanship or material.

This warranty does not extend to damage resulting from misuse, neglect or abuse, normal wear and tear, or accident. This warranty extends only to the original customer purchaser.

IN NO EVENT SHALL HARVARD APPARATUS BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states do not allow exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. **THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR USE, OR OF ANY OTHER NATURE.** Some states do not allow this limitation on an implied warranty, so the above limitation may not apply to you.

If a defect arises within the one-year warranty period, promptly contact ***Harvard Apparatus, Inc. 84 October Hill Road, Holliston, Massachusetts 01746-1371*** using our U.S. only toll free number 1-800-272-2775 or dial (508) 893-8999. Goods will not be accepted for return unless an RMA (returned materials authorization) number has been issued by our customer service department. The customer is responsible for shipping charges. Please allow a reasonable period of time for completion of repairs, replacement and return. If the unit is replaced, the replacement unit is covered only for the remainder of the original warranty period dating from the purchase of the original device.

This warranty gives you specific rights, and you may also have other rights which vary from state to state.

Repair Facilities and Parts

Harvard Apparatus stocks replacement and repair parts. When ordering, please describe parts as completely as possible, preferably using our part numbers. If practical, enclose a sample or drawing. We offer a complete reconditioning service.

CAUTION

This pump is not registered with the FDA and is not for clinical use on human patients.

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Specifications

Virtually Pulse Free 'VPF' Dual Syringe Pump '11'	
Type	Microprocessor single or dual syringe, infusion only
Syringe Size	2 plastic or glass from 0.5 µl to 10 ml
Flow Rate Range:	
Minimum	0.01 µl/hr with 0.5 µl syringe
Maximum	10.40 ml/hr with 10 ml syringe
Calibration	Automatic, enter syringe ID up to 15.9 mm
Display	4 digits and 4 LED indicators
Nonvolatile Memory	Storage of all settings
Maximum Force	11.35 kg (25 lb)*
Drive Motor	7.5° step geared 300:1, 0.025° micro step angle motor
Step Rate:	
Minimum	1 pulse in 27.6 sec
Maximum	200 steps/sec
Pusher Advance/Step	1.322 µm
Dynamic Range	5461 to 1
Leakage to Ground	Typically < 10 µA
Ground Resistance	Typically < 0.05
Voltage Range	95/130 VAC; 220/260 VAC
Power	115/230 VAC, 50/60 Hz, via internal selector switch, 15 W, 0.25 A fuse
Size, H x W x D	11.4 x 22.9 x 11.4 cm (4-1/2 x 9 x 4-1/2 in)
Weight	2.1 kg (4.6 lb)

**Actual force is higher. Not recommended for applications more than 25lbs of force.*

The Pump 11 has been designed as a low cost, high precision single syringe infusion pump with moderate back pressures.

The pump can take one or two syringes of any make, any size from 0.5 µl to 10 ml. The diameter of the syringe(s) is entered via the keyboard and the internal microprocessor calculates the cross-sectional area to calibrate the pump for that syringe.

The microprocessor automatically determines if the flow rate is to be expressed in µl/hour or ml/hour depending on the syringe size.

Non-volatile memory stores the last syringe diameter and flow rate used.

A unique "Power Failure Mode" selector can be set to either turn the pump off in the event of power failure or to resume pumping when power resumes.

Easy-To-Use

Only two entries requried, syringe Inside Diameter (ID) and the flow rates. The Flow rate can be changed while the Pump is running.

Nonvolatile Memory

The pump remembers its last syringe size and flow rate used.

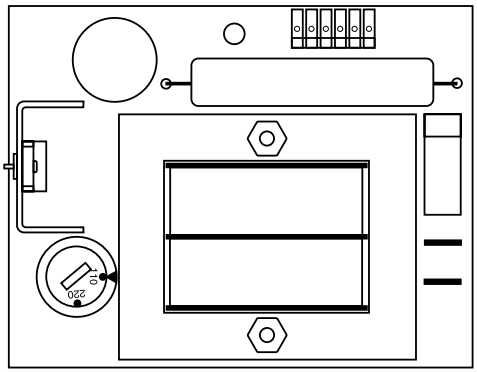
Momentary Loss of Power

In a power failure the Pump can either RESUME or STOP pumping when power is returned.

1. Read the entire manual.
2. Pumps are shipped from the factory with an American line cord with three wire molded power connector and the pump set for 110 to 220 VAC. To change voltage, locate the voltage selector switch, by removing 4 screws on the bottom panel, 2 on each end of the pump. Identify the voltage selector switch located directly below where the line cord enters the pump. Using a screw driver, turn the switch and set it to the voltage being used. If other than 115V, 60 Hz is being used, the plug must be cut off and an appropriate plug installed observing the polarity of the international line cord used:

   Brown: **High**
   Blue: **Neutral**
   Green: **Ground**

3. Turn on main power switch located directly above the line cord on the rear panel. The display will now illuminate indicating that the power connections are correct. The flashing number displayed is the current flow rate. Flashing indicates that power has just been applied.



Voltage selector switch and fuse for 110/220V.

To Load the Syringe

a) Release the syringe pusher by pressing the bronze button on the side of the pusher.

b) While holding the bronze button "in" slide the pusher to the left.

c) Raise the spring loaded stainless steel syringe retainer and swing it out of the way.

d) Lay the loaded syringe in the "V" shaped holder.

e) Swing the retainer so it holds the syringe in place.

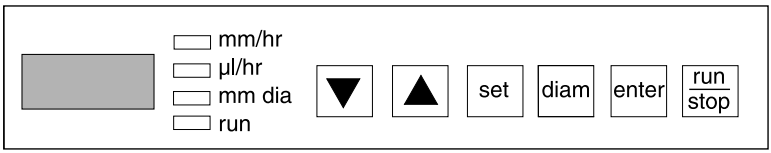
f) Move the pusher so it makes contact with the head of the syringe.

1. Turn Pump 'ON'

Locate the main power switch at the rear of the pump and turn it to the "ON" position. The display will now blink indicating that power is being supplied to the pump. Press any key to stop blinking. Pump is ready for operation.

2. Function Keys

Refer to the colored keypad at the front of the pump to identify the following functions starting from the right.



RUN/STOP
This turns the pump motor on and off.

ENTER
This key enters data that is on LED display into memory of pump.

DIAM
Used to enter syringe diameter.

s t
Ascending and descending keys are used to change numbers on display. s– Up key makes numbers increase, t– Down Key makes numbers decrease.

SET
This key is used to select which digit of the display is to be adjusted. Each time the set key is pressed the digit on the display is moved one step to the right. It is used in conjunction with the ascending and descending keys. Each digit starting from the left will blink. When it reads the correct value the set key will stop the blinking and advance to the next digit which will blink.

3. Enter Syringe Make & Size

To enter the diameter of your syringe, identify the make and size of your syringe. Referring to Table 1 determine the inside diameter in mm. If your syringe is not listed, then measure the diameter and record for future use. Enter the syringe diameter using the following example of a Becton-Dickinson plastic syringe, plastipak size 10 cc. The chart in Appendix A shows the diameter to be 14.50 mm. This is the number we want to enter into the pump.

a) Turn on power using switch in rear of pump; display should blink.

b) Press SET followed by DIAM. The previously used diameter will appear on display with left hand digit blinking. The "mm dia" legend to right side of display will be illuminated indicating that display is reading diameter. Use UP and DOWN keys to set desired number on left hand digit. Using our example of 14.50, set left hand digit to 1 and press SET key. The 1 will now stop blinking and the next digit to right will blink. Using the example and UP and DOWN keys set second digit to 4. Again press SET key and next digit will blink. Continue doing this until 14.50 is displayed.

c) Press ENTER key to put this diameter into memory.

d) Display will now revert to show RATE.

e) Verify that correct diameter has been entered by pressing and holding "DIAM" key. Display should read what was entered 26.70.

4. Enter Flow Rate

a. Press SET to put display in set mode.

b. Using UP and DOWN keys, enter desired flow rate. Press ENTER key to put rate into memory.

c. With rate and diameter information entered, the microprocessor makes the following decisions:

1. If syringe size is small then flow rate display will read µl/hr.
2. If larger syringe is selected then display will read ml/hr.
3. If flow rate selected is beyond capabilities of pump, either by being too fast or too slow, display will indicate OOR standing for "out of range".

d. Table 2 on page 11 contains maximum and minimum possible flow rates and relevant units for each size syringe.

5. Press Start

Start infusion by pressing START/STOP key. Display will indicate numerical flow rate, units of flow and run light will be illuminated.

6. Check Syringe Often

Pump 11 will not shut itself off when syringe hits bottom or is otherwise overloaded. When stalled, run light will continue to be illuminated. Check syringe from time to time to make sure it is infusing.

7. Power Failure

In the event of a momentary or prolonged power failure Pump 11 can be set to either:

a. Resume pumping when power is returned (PF-1), with run light illuminated.

b. Not start pumping when power is resumed (PF-0).

In either situation, display will flash indicating a power failure. To set power failure mode press SET and RUN/STOP. Display will read PF-0 or PF-1 with 0 or 1 blinking. To change from one mode to other press UP or DOWN keys, then press ENTER.

8. Changing Rates

If pump is running at an existing rate, it will continue to do so while new rate is being entered. As soon as ENTER key is pressed, pump will instantly change to new rate.

9. Maintenance

No special maintenance is required other than keeping pump clean and dry. Avoid liquid spills that may find their way into electronics.A container of grease is provided for periodic lubrication of lead screw as well as a bottle of oil for periodic lubrication of two stainless steel guide rods. It is important to keep these guide rods clean.

10. Fuse Replacement

Make sure power cord is disconnected from main supply before replacing fuse. Locate fuse holder on rear panel of pump. Use straight blade screwdriver to turn gray fuse carrier counter clockwise, remove fuse from carrier. Replace fuse and fuse carrier. For continued fire protection replace fuse only with 250V fuse of specified type and rating. (3AG 1/4 AMP 250V SLO-BLO)

11. Use of Microliter Syringes

Pump 11 will take microliter syringes down to 0.5 µl size.These syringes have fine wire plunger that will be damaged if plunger hits bottom. Pump is equipped with adjustable collar on one of guide rods.Adjust collar so pusher stops before plunger hits bottom.

WARNING: Use in manner not specified by the manufacturer may impair the protection provided by the equipment.

Appendix A: Common Syringe Diameters

Stainless Steel

Size	Diameter
8 cc	9.525 mm
20 cc	19.130
50 cc	28.600
100 cc	34.900

Becton Dickinson Plastic "Plasticpak"

Size	Diameter
1 cc	4.78 mm
3	8.66
5	12.06
10	14.50
20	19.13
30	21.70
50/60	26.70

Air–Tite "All Plastic"

Size	Diameter
2.5 cc	9.60 mm
5.0	12.45
10	15.90
20	20.05
30	22.50
50	29.00

Unimetrics Series 4000 & 5000

Size	Diameter
10 µl	0.460 mm
25	0.729
50	1.031
100	1.460
250	2.300
500	3.260
1000	4.610

Terumo

Size	Diameter
3 cc	8.95 mm
5	13.00
10	15.80
20	20.15
30	23.10
60	29.10

Sherwood Monoject Plastic

Size	Diameter
1 cc	4.65 mm
3	8.94
6	12.70
12	15.90
20	20.40
35	23.80
60	26.60
140	38.40

Popper & Sons, Inc. "Perfektum" Glass

Size	Diameter
0.25 cc	3.45 mm
0.5	3.45
1	4.50
2	8.92
3	8.99
5	11.70
10	14.70
20	19.58
30	22.70
50	29.00
100	35.70

SGE (Scientific Glass Engineering)

Size	Diameter
25 µl	0.73 mm
50	1.03
100	1.46
250	2.30
500	3.26
1.0 ml	4.61 mm
2.5	7.28
5	10.30
10	14.57

Hamilton Microliter Series Gastight

Size	Diameter
.5 µl	0.103 mm
1	0.1457
2	0.206
5	0.3257
10	0.460
25	0.729
50	1.031
100	1.46
250	2.3
500	3.26
1.0 ml	4.61 mm
2.5	7.28
5	10.3
10	14.57
25	23.0
50	32.6

Appendix B: Nominal Max/Min Flow Rates

Various Syringes; Actual Limits Will Vary Depending on Manufacturer

Nominal Syringe Size	Nominal Diameter (mm)	µl/hr min	µl/hr max	ml/hr min	ml/hr max
0.5 µl	0.10	0.01	0.45		
1 µl	0.15	0.01	1.07		
2 µl	0.21	0.01	2.15		
5 µl	0.33	0.01	5.38		
10 µl	0.46	0.01	10.55		
25 µl	0.73	0.01	25.85		
50 µl	1.03	0.01	52.91		
100 µl	1.46	0.01	100.0		
250 µl	2.30	0.01	260.0		
500 µl	2.30	0.01	520.0		
1,000 µl	3.26			0.01	1.05
1 ml	4.61			0.01	1.13
2 ml	7.28			0.01	4.14
2.5 ml	7.28			0.01	3.73
3 ml	8.66			0.101	3.73
5 ml	10.30			0.05	7.20
10 ml	14.57			0.05	10.40